

Claims:

1. A photoreceptor comprising
a top durable layer that is charge generating and/or charge transporting; and
a bottom layer that is bipolar charge transporting or bipolar charge generating,
wherein the photoreceptor has a negative charging mode of operation.
2. The photoreceptor of claim 1, wherein said top durable layer has a thickness of up to about 10 microns.
3. The photoreceptor of claim 2, wherein said top durable layer has a thickness of about 2.0 to about 7.0 microns.
4. The photoreceptor of claim 1, wherein said top durable layer is both charge generating and charge transporting.
5. The photoreceptor of claim 4, wherein said top durable layer comprises a dispersion of about 5-15% pigment by weight of the total solid layer, about 50-60% by weight binder of the total solid layer, about 10-30% of total coating solution weight as solvent and about a 3:2 ratio of hole transport molecules to electron transport molecules.
6. The photoreceptor of claim 5, wherein the hole transport molecules and electron transport molecules are about 20-30% by weight of the total solid layer.
7. The photoreceptor of claim 5, wherein said pigment is selected from hydroxygallium phthalocyanine (HOGaPC), x metal-free phthalocyanine (x-H₂PC), benzylimidizo perylene (BZP), 535+dimer and mixtures thereof.

8. The photoreceptor of claim 5, wherein said binder is selected from bisphenol-Z polycarbonate (PCZ), PCZ-500 (avg. mol. wgt. 51,000), PCZ-400 (avg. mol. wgt 40,000), Luckamide, Elvamide, mTBD-based polymer, e-transport polymers and mixtures thereof.

9. The photoreceptor of claim 8, wherein said binder is Luckamide.

10. The photoreceptor of claim 5, wherein said solvent is selected from tetrahydrofuran (THF), toluene, methylene chloride, monochlorobenzene (MCB), cyclohexane, alcohols and mixtures thereof.

11. The photoreceptor of claim 5, wherein said hole transport molecules are selected from N,N'-diphenyl-N,N'-bis(3-hydroxyphenyl)-[1,1'-biphenyl]-4,4'-diamine (DHTBD); N,N'-diphenyl-N,N'-bis(alkylphenyl)-1,1-biphenyl-4,4'-diamine (mTBD); Tri-p-tolylamine (TTA); N,N'-bis-(3,4-dimethylphenyl)-4-biphenylamine (Ae-18); N,N'-bis(4-methylphenyl)-N,N'-bis(4-ethylphenyl)-11'-3,3'-dimethylbiphenyl-4,4'-diamine (AB-16); and mixtures thereof.

12. The photoreceptor of claim 5, wherein said electron transport molecules are selected from N,N'-bis(1,2-dimethylpropyl)-1,4,5,8-naphthalenetetracarboxylic diimide (NTDI) and modified NTDI's for higher solubility; 1,1'-dioxo-2-(4-methylphenyl)-6-phenyl-4-(dicyanomethylidene)thiopyran (PTS); butylcarboxylate fluorenone malononitrile (BCFM); 2-ethylehexylcarboxylate fluorenone malononitrile (2EHCFM), 1,1-(N,N'-bisalkyl-bis-4-phthalimido)-2,2-biscyano-ethylenes (BIB-CNs) and mixtures thereof.

13. The photoreceptor of claim 4, wherein said bottom layer is a bipolar charge transport layer.

14. The photoreceptor of claim 13, wherein said bottom layer has a thickness of up to about 15 microns.

15. The photoreceptor of claim 14, wherein said thickness is about 8 to 12 microns.

16. The photoreceptor of claim 13, wherein said bottom layer comprises up to about 50% by weight of the total layer of hole transport molecules and electron transport molecules, about 10-40% by weight binder and about 75-95% by weight solvent.

17. The photoreceptor of claim 16, wherein said binder is selected from bisphenol-Z polycarbonate (PCZ), PCZ-500 (avg. mol. wgt. 51,000), PCZ-400 (avg. mol. wgt 40,000), Luckamide, Elvamide, mTBD-based polymer, e-transport polymers and mixtures thereof.

18. The photoreceptor of claim 16, wherein said solvent is selected from tetrahydrofuran (THF), toluene, methylene chloride, monochlorobenzene (MCB), cyclohexane, alcohols and mixtures thereof.

19. The photoreceptor of claim 16, wherein said hole transport molecules are selected from N,N'-diphenyl-N,N'-bis(3-hydroxyphenyl)-[1,1'-biphenyl]-4,4'-diamine (DHTBD); N,N'-diphenyl-N,N'-bis(alkylphenyl)-1,1-biphenyl-4,4'-diamine (mTBD); Tri-p-tolylamine (TTA); N,N'-bis-(3,4-dimethylphenyl)-4-biphenylamine (Ae-18); N,N'-bis(4-methylphenyl)-N,N'-bis(4-ethylphenyl)-11'-3,3'-dimethylbiphenyl-4,4'-diamine (AB-16); and mixtures thereof.

20. The photoreceptor of claim 16, wherein said electron transport molecules are selected from N,N'-bis(1,2-dimethylpropyl)-1,4,5,8-naphthalenetetracarboxylic diimide (NTDI) and modified NTDI's for higher solubility; 1,1'-dioxo-2-(4-methylphenyl)-6-phenyl-4-(dicyanomethylidene)thiopyran (PTS); butylcarboxylate fluorenone malononitrile (BCFM); 2-ethylehexylcarboxylate fluorenone malononitrile (2EHCFM), 1,1-(N,N'-bisalkyl-bis-4-phthalimido)-2,2-biscyano-ethylenes (BIB-CNs) and mixtures thereof.

21. The photoreceptor of claim 1, wherein said top layer is a charge transport layer.

22. The photoreceptor of claim 21, wherein said top layer has a thickness of up to about 10 microns.

23. The photoreceptor of claim 21, wherein said top layer comprises a dispersion of about 50-70% by weight charge transport molecules, about 30-50% by weight binder and about 15-25% by weight of solvent by weight of the dispersion.

24. The photoreceptor of claim 23, wherein said charge transport molecules are hole transport molecules and electron transport molecules, the hole transport molecules are selected from N,N'-diphenyl-N,N'-bis(3-hydroxyphenyl)-[1,1'-biphenyl]-4,4'-diamine (DHTBD), N,N'-diphenyl-N,N'-bis(alkylphenyl)-1,1-biphenyl-4,4'-diamine (mTBD), Tri-p-tolylamine (TTA); N,N'-bis-(3,4-dimethylphenyl)-4-biphenylamine (Ae-18), N,N'-bis(4-methylphenyl)-N,N'-bis(4-ethylphenyl)-11'-3,3'-dimethylbiphenyl)-4,4'-diamine (AB-16), and mixtures thereof; and said electron transport molecules are selected from N,N'-bis(1,2-dimethylpropyl)-1,4,5,8-naphthalenetetracarboxylic diimide (NTDI) and modified NTDI's for higher solubility; 1,1'-dioxo-2-(4-methylphenyl)-6-phenyl-4-(dicyanomethylidene)thiopyran (PTS); butylcarboxylate fluorenone malononitrile (BCFM); 2-ethylehexylcarboxylate fluorenone malononitrile (2EHCFM),

1,1-(N,N'-bisalkyl-bis-4-phthalimido)-2,2-biscyano-ethylenes (BIB-CNs) and mixtures thereof.

25. The photoreceptor of claim 23, wherein said binder is selected from bisphenol-Z polycarbonate (PCZ), PCZ-500 (avg. mol. wgt. 51,000), PCZ-400 (avg. mol. wgt 40,000), Luckamide, Elvamide, mTBD-based polymer, e-transport polymers and mixtures thereof.

26. The photoreceptor of claim 23, wherein said solvent is selected from tetrahydrofuran (THF), toluene, methylene chloride, monochlorobenzene (MCB), cyclohexane, alcohols and mixtures thereof.

27. The photoreceptor of claim 21, wherein said bottom layer is a bipolar charge generating layer.

28. The photoreceptor of claim 27, wherein said bottom layer has a thickness of up to about 15 microns.

29. The photoreceptor of claim 28, wherein said bottom layer has a thickness of about 8-15 microns.

30. The photoreceptor of claim 27, wherein said bottom layer comprises about 2-20% by weight pigments of total solids, about 40-78% by weight charge transport molecules and about 20-40% by weight binder.

31. The photoreceptor of claim 30, wherein said pigment is selected from hydroxygallium phthalocyanine (HOGaPC), x metal-free phthalocyanine (x-H₂PC), benzyimidizo perylene (BZP), 535+dimer and mixtures thereof.

32. The photoreceptor of claim 30, wherein charge transport molecules are hole transport molecules and electron transport molecules, the hole transport molecules are selected from N,N'-diphenyl-N,N'-bis(3-hydroxyphenyl)-[1,1'-biphenyl]-4,4'-diamine (DHTBD), N,N'-diphenyl-N,N'-bis(alkylphenyl)-1,1-biphenyl-4,4'-diamine (mTBD), Tri-p-tolylamine (TTA); N,N'-bis-(3,4-dimethylphenyl)-4-biphenylamine (Ae-18), N,N'-bis(4-methylphenyl)-N,N'-bis(4-ethylphenyl)-11'-3,3'-dimethylbiphenyl)-4,4'diamine (AB-16), and mixtures thereof; and said electron transport molecules are selected from N,N'-bis(1,2-dimethylpropyl)-1,4,5,8-naphthalenetetracarboxylic diimide (NTDI) and modified NTDI's for higher solubility, 1,1'-dioxo-2-(4-methylphenyl)-6-phenyl-4-(dicyanomethylidene)thiopyran (PTS), butoxy carbonyl fluorenylidene malononitrile (BCFM), BIB-CNs and mixtures thereof.

33. The photoreceptor of claim 30, wherein said binder is selected from bisphenol-Z polycarbonate (PCZ), PCZ-500 (avg. mol. wgt. 51,000), PCZ-400 (avg. mol. wgt 40,000), Luckamide, Elvamide, mTBD-based polymer, e-transport polymers and mixtures thereof.

34. The photoreceptor of claim 21, wherein said photoreceptor additionally comprises a thin bipolar or hole transport charge transport layer between said top and bottom layers.

35. The photoreceptor of claim 34, wherein said thin bipolar or hole transport charge transport layer has a thickness of up to about 10 microns.

36. The photoreceptor of claim 34, wherein said top layer has a thickness of about 1 to 5 microns.

37. The photoreceptor of claim 1, wherein said photoreceptor additionally comprises a substrate.

38. The photoreceptor of claim 1, wherein said photoreceptor has a negative charging mode of operation.

39. A top surface charge generating photoreceptor comprising:
a top charge generation and charge transport layer; and
a bottom bipolar charge transport layer.

40. A bottom charge generating photoreceptor comprising:
a top charge transport layer; and
a bipolar charge generating layer.